

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/AU04/001820

International filing date: 23 December 2004 (23.12.2004)

Document type: Certified copy of priority document

Document details: Country/Office: AU
Number: 2003907125
Filing date: 24 December 2003 (24.12.2003)

Date of receipt at the International Bureau: 25 January 2005 (25.01.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse



Australian Government

Patent Office
Canberra

I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003907125 for a patent by BUSHWATER HOLDINGS PTY LTD as filed on 24 December 2003.

WITNESS my hand this
Fourteenth day of January 2005

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
AND SALES



AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant:

BUSHWATER HOLDINGS PTY LTD

Invention Title:

A SYSTEM FOR WATER TREATMENT

The invention is described in the following statement:

A SYSTEM FOR WATER TREATMENT

The present invention relates to water treatment systems and in particular smaller treatment plants such as those used in domestic applications.

5 Existing home sewerage treatment plants are limited in their application to domestic dwellings on larger blocks of land. This is because the treated water output from the plants is still of inadequate quality to meet regulatory requirements. Therefore in large housing 10 developments on small blocks of land the treated water which is output from a larger number of domestic treatment plants can be a health hazard if there is inadequate space.

15 There is a need therefore to produce a superior type of water treatment system which has improved treated water output so as to enable usage of the water treatment system in a more highly densified population environment.

20 The present invention provides a system for water treatment which may have benefits in producing superior quality treated water over a common variety water treatment system with a basic anaerobic and aerobic treatment tank.

25 According to the present invention there is provided a system for water treatment comprising a first treatment area for receiving waste water and aerating the waste water to enhance aerobic bacterial treatment of waste water, a second treatment area for receiving waste water from the first treatment area and circulating waste water within it to enhance anoxic/anaerobic bacterial 30 treatment of waste water, a third treatment area configured to receive waste water from the second treatment area and including a filter having at least one membrane for filtering the waste water to substantially remove particulate matter of a predetermined size, an 35 outlet connected to the filter and configured to output filtered waste water from the filter and a transfer means for transferring waste water from the third treatment area

to the first treatment area.

Preferably the transfer means transfers waste water directly from the first treatment area to the third treatment area.

5 According to one embodiment the transfer means transfers waste water indirectly from the third to the first transfer area.

It is preferred that the transfer means includes at least one conduit.

10 The first treatment area may include a chamber. The second treatment area may include a second chamber.

The chambers may be located inside a large tank.

15 Preferably the first treatment area includes a circulation means for circulating waste water within the first treatment area.

The transfer means may comprise an opening in a common wall between the first and third treatment areas.

Preferably the opening includes an insert.

20 The insert may be threaded so as to screw into the opening.

Preferably the opening has a reducing width to reduce blockage.

25 Preferably the opening is located between high and lower water levels in the system.

The transfer means may comprise a pipe connecting the third and first treatment areas.

30 It is preferred that the system includes first pressure means for transferring waste water from the first to second treatment areas.

Preferably the system includes second pressure means for transferring waste water from the second to the third treatment area.

35 The system may include a third pressure means for transferring waste water from the third to the first treatment area.

According to one embodiment the system includes a

fourth treatment area and the transfer means is configured to transfer waste from the third treatment area to the fourth treatment area.

5 Preferably waste water is transferred from the fourth treatment area to the first treatment area.

The transfer means preferably includes one or more conduits connecting the third treatment area with the first treatment area.

10 Preferably the third transfer area includes a circulation means for circulating waste water within it.

The first treatment area may be connected to the second treatment area through a first feed means.

The feed means may include a conduit.

The first feed means may include a pump.

15 The first feed means may include a gravity feed system.

The second treatment area preferably is connected to the third treatment area through a second feed means.

20 The second feed means may have one or more features of the first feed means.

The transfer means may include a pump for pumping waste water from the third treatment area to the fourth treatment area.

25 The transfer means may include a pump for pumping waste water from the fourth treatment area to the first treatment area.

The fourth treatment area may include a circulation means for circulating waste water within the fourth treatment area.

30 The system may include one or more additional treatment areas connected directly or indirectly to the fourth or third treatment areas.

The first treatment area may include a first tank.

35 The second treatment area may include a second tank.

The third treatment area may include a third

tank.

The fourth treatment area preferably includes a chamber located within the first treatment area.

5 According an alternative embodiment the fourth treatment area comprises a tank separate from the third and first treatment areas.

According to one embodiment the first treatment area is located between the second and third treatment areas.

10 The first treatment area may be a partitioned area in a large tank.

The second and third treatment areas may be partitioned areas within the same large tank.

15 Preferably the second treatment area includes a sludge circulation means.

The second treatment area may include at least one pipe which draws sludge from the bottom of the second treatment area and outputs it at a top end of the second treatment area.

20 The sludge circulation means may include a plurality of pipes.

The plurality of pipes may be vertically arranged.

25 According to one embodiment of the invention the transfer means includes a conduit between the third and first treatment areas.

30 The system preferably includes a control means for controlling waste water entering and leaving the system to maintain the waste water level between upper and lower limits.

The control means preferably includes a float switch.

The fourth treatment area may include a partitioned chamber located in the first treatment area.

35 The partitioned chamber may include an opening in a bottom surface.

Preferably the filter comprises a plurality of

membranes.

According to one embodiment there is provided a feedback pipe from the third treatment area to the second treatment area.

5 Preferably the inlet of the feedback pipe is located at a bottom of third treatment area.

The second treatment area preferably maintains a substantially homogenous sludge waste water mix.

10 The first treatment area preferably maintains a substantially homogenous sludge waste water mix.

The system preferably includes an outlet for transferring waste water from the filter.

It is preferred that water passing through the outlet is fed by a head of waste water above the filter.

15 It is preferred that the water level within the third treatment area is maintained between the upper and lower limits.

It is to be understood that, if any prior art publication is referred to herein, such reference does not 20 constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or in any other country.

25 A preferred embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a schematic diagram of a water treatment system according to a preferred embodiment of the present invention; and

30 Figure 2 shows a cross-sectional view of a self-cleaning hole used in the preferred embodiment of the present invention.

35 The preferred embodiment of the invention shown in Figure 1 consists of a circular water tank 11 which is divided into a central primary treatment area 12, a secondary treatment area 13 and a tertiary treatment area 14.

Although the secondary and tertiary treatment

areas are shown as being on either sides of the primary treatment area they maybe situated close to each other.

Waste water to be treated is fed into the primary treatment area and typically includes solid particulate matter. A circulating pump 15 preferably a centrifugal submersible with open style impeller and integral float switch is located in the primary chamber to continually circulate waste water and particulate matter. Emulsifying aerators are also located within the primary chamber and are located such that water flow from each unit is in the same direction but at 180° to each other.

The circulating pump and emulsifier aerators ensure maximum aerobic bacterial activation within the primary chamber.

A controller connected to a float switch ensures the level of waste water within the tank does not fall below a minimum limit. This minimum limit is in part determined so as to ensure that the circulating pump does not dry run.

Waste water from the primary chamber is pumped to the secondary chamber 13 for anoxic and where possible anaerobic bacterial treatment. This secondary treatment area 13 may be in the form of a recycle tank containing pipe work for the inlet of liquid that is pumped from the primary treatment tank.

The inlet flow to the secondary treatment area is from top to bottom. The recycle tank contains three airlift pumps that are constructed from PVC plastic that are at 90° to each other.

The operation of the recycle tank air lift pumps is to lift sludge from the bottom of the recycle tank to the top where the air and water discharges via a T-fitting located internal to the tank and below the top opening.

It is preferred that the air lift pumps include vertical conduits which extend from the upper water level limit to the bottom of the tank.

The recycle tank also contains another PVC pipe

that runs from top to bottom of the tank and directs sludge flow to the bottom of the recycle tank.

5 Waste water from the recycle tank 13 is transferred to the tertiary treatment tank 14 by 50mm diameter flexible pipe that is located close to the top of both the recycle tank and the tertiary treatment tank 14 with a hydraulic fall to the tertiary treatment tank.

10 In general operation the recycle tank always has a liquid height such that the liquid level is at the same level as the recycle tank outlet.

The tertiary treatment area 14 is in the form of a membrane tank that is located in the main tank forming the primary treatment area.

15 The membrane tank 14 contains a membrane bioreactor assembly 19 that is submerged in activated sludge of higher concentration than the activated sludge contained in the primary treatment area 12. The membrane bioreactor consists of a submerged membrane filter unit typically having membrane cartridges. The membrane unit 19 is able to sit at the bottom of the tertiary treatment area 14 and is connected through pipework 20 through an opening in the side wall of the tank 11 to a treated water tank 21.

20 The membrane unit serves as a final filtering assembly which is able to restrict passage of sludge or microorganisms into the treatment tank 21.

25 The membrane unit is preferably supported by plastic or stainless steel stays. One end of the stays are attached to the membrane unit and the other end is attached to the top of the treatment tank 14. This serves to support the membrane unit in a vertical position and at a nominated depth of submergence.

30 In addition to the above the membrane tank 14 has an air entry pipe, a chlorine membrane cleaning pipe and a water wash pipe extending downwards from the top of the membrane tank and connected to the membrane unit.

35 Furthermore in addition to the above a waste

water opening 22 is provided through the common wall separating the membrane tank from the primary treatment tank 12 preferably between high and low level waste water limits.

5 This opening 22 enables particulate matter including sludge to pass with the waste water back into the primary treatment tank 12. This assists with reducing the concentration of sludge in the membrane tank 14 which is otherwise found to build up in this tank to 10 concentration levels higher than that in the primary and secondary tanks 12 and 13.

15 As shown in Figure 2 the opening 22 may be contoured to have a reducing diameter from the membrane tank 14 to the primary treatment tank 12. This helps provide a self-cleaning aspect to the hole and reduces problems associated with blocking of the hole.

20 According to one embodiment the hole may also be provided with a tubular insert which is screwed into a threaded hole created in the common wall of the membrane and primary tanks 14 and 12.

25 The membrane tank 14 has a float switch (No. 1) which is attached to the top of the tank 11. This float switch (not shown) hangs down into the membrane tank and switches on and off the primary tank feed pump. This float switch (No. 1) serves to maintain the water level in the membrane tank 14 between the upper water level limit U and the lower water level limit L.

30 The feed pump in the primary chamber 12 then pumps liquid to the recycle tank 13 which overflows to fill the membrane tank 14. The feed pump is submersed at a particular depth so as to maintain a minimum of 2,000 litres in the primary tank 12.

35 Another float switch (No. 2) is located above the feed pump and is set so that a minimum of 2,000 litres of tank volume is available both above and below the float switch No. 2. An additional float switch (No. 3) is located above float switch No. 2 at a height of

approximately 300mm above float switch no. 2. This float switch is used to activate the alarm system to indicate the upper water level has been reached.

5 The water membrane tank 14 has a lower limit L to provide sufficient height of water above the membrane unit 19 to give transmembrane pressure sufficient to activate the membrane bioreactor. The float switch No. 1 in this tank ensures that the level does not drop below level L by controlling the feed pump.

10 The water membrane tank 14 also has an airlift pump that transfers liquid from the membrane tank 14 through conduit 23 to the recycle tank 13.

15 The opening 22 between the membrane tank 14 and primary treatment tank 12 may be replaced by a conduit and a pump which pumps waste water into the primary treatment tank 12.

20 According to another embodiment a further treatment tank or tanks may be added to the system so that waste water can be pumped out of the membrane tank so as to reduce the level of sludge therein. Water in these final treatment tank(s) can then be pumped back into the primary treatment tank 12. Alternatively a gravity feed can be used for transference of the waste water into the primary treatment tank.

25 According to another variation of the invention the tertiary treatment area is located within the primary treatment tank and may include a series of baffles which are located in close proximity to the opening 22 to segregate water initially entering the primary treatment tank from the membrane tank 14. Alternatively a small tank may be located inside the primary tank and the opening may include a conduit feeding straight into this tank. The bottom of the tank may be perforated to allow waste water to travel into the rest of the primary treatment area.

30 According to another embodiment the primary treatment tank may include an inlet baffle that directs

inlet water flow downwards towards the base of this tank. Located internal to the baffle may be a metal strainer that is constructed of perforated metal with approximately 3mm holes covering the majority of the surface of the
5 strainer.

According to another embodiment of the present invention a plurality of holes may be provided in the common wall separating the membrane tank 14 from the primary treatment tank 12.

10 The membrane tank 14 preferably has a circulation pump which serves to circulate activated sludge within the membrane tank 14. The same or an additional cleaning or circulating device may be used to periodically wash down the membrane unit 19.

15 With the system described above the treated water entering the treatment tank 21 has improved characteristics over more basic domestic treatment plants.

By having a separate membrane tank it is possible to utilise a membrane unit. The membrane tank provides 20 sufficient height of water above the membrane unit to give transmembrane pressure sufficient to actuate the membrane bioreactor. In addition the recycle tank is able to maintain an inventory of oxygen limited sludge that provides sludge to the membrane tank 14. Furthermore the 25 provision of a membrane bioreactor makes it possible to treat polluted water such as grey water, black water, sewerage and some industrial waste to a level such that reuse and recycling is possible.

In the claims which follow and in the preceding 30 description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but 35 not to preclude the presence or addition of further features in various embodiments of the invention.

Variations and modifications can be made in respect of the invention described above and defined in the following statement of claim

1.. A system for water treatment comprising a
5 first treatment area for receiving waste water and
aerating the waste water to enhance aerobic bacterial
treatment of waste water, a second treatment area for
receiving waste water from the first treatment area and
circulating waste water within it to enhance
10 anoxic/anaerobic bacterial treatment of waste water, a
third treatment area configured to receive waste water
from the second treatment area and including a filter
having at least one membrane for filtering the waste water
to substantially remove particulate matter of a
15 predetermined size, an outlet connected to the filter and
configured to output filtered waste water from the filter
and a transfer means for transferring waste water from the
third treatment area to the first treatment area.

20 Dated this 24th day of December 2003

BUSHWATER HOLDINGS PTY LTD

By their Patent Attorneys

GRIFFITH HACK

Fellows Institute of Patent and

25 Trade Mark Attorneys of Australia

Fig 1

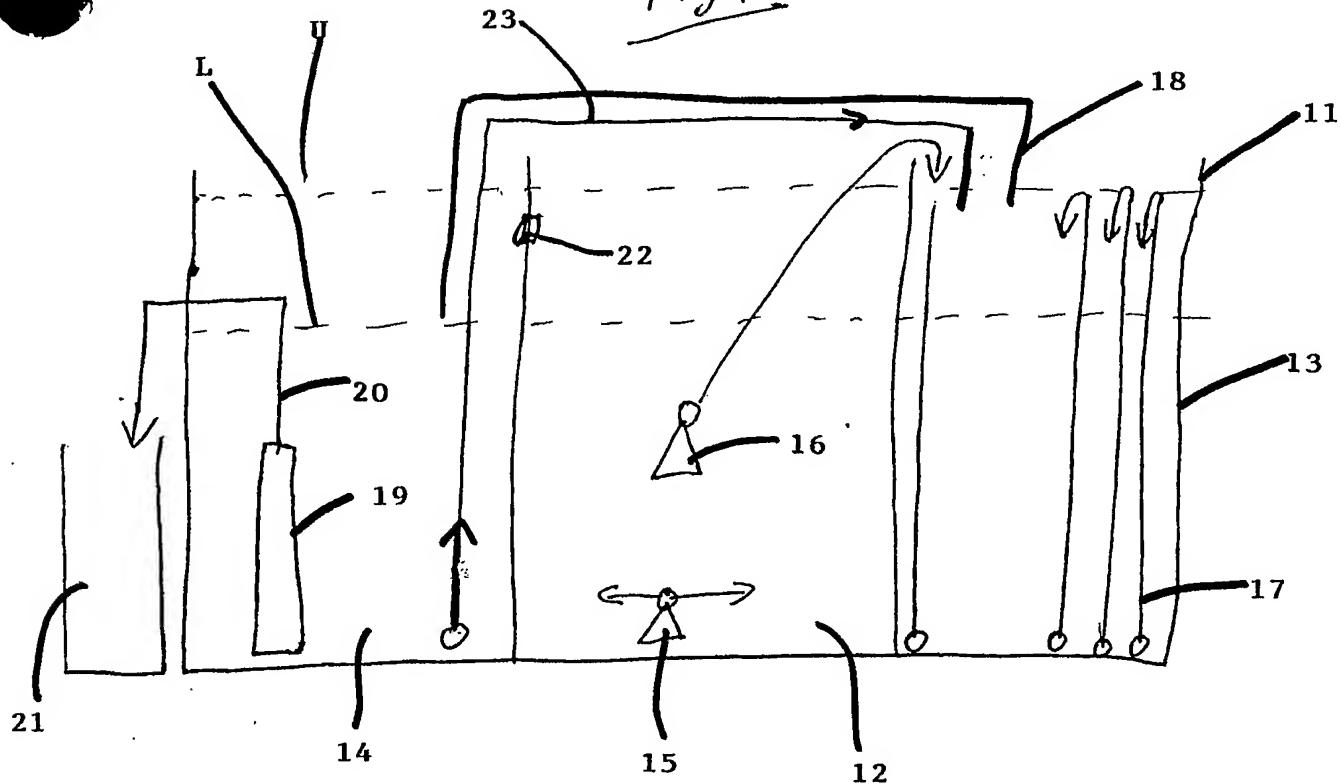


Fig 2

